U.S. TRADE AND DEVELOPMENT AGENCY

EXECUTIVE SUMMARY

Feasibility Study for the EDL Billing and Revenue Collection Modernization Project

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U.S. Firm: Alpha-Gamma Technologies, Inc.
Main Contact Name: Brahim Richani, Project Manager
Current Phone: 919-954-0033
Fax: 919-954-0379

Project Sponsor: Electricite du Liban (EDL)
Main Contact Name: Georges Mouawad, General Director
Current Phone: 961-1-442-720
Fax: 961-1-583-084

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This report provides the feasibility study results for modernizing the electricity metering and revenue collection systems for Electricite du Liban (EDL), the national power company of Lebanon. The U.S. Trade and Development Agency (MA) provided a grant to the Ministry of Hydraulic and Electric Resources (NIHER) to conduct this feasibility study, and Alpha-Gamma Technologies, Inc. was awarded this effort by EDL. Alpha-Gamma was assisted on this project by ABB Power T&D Company, Inc. as a subcontractor.

The objective of this study is to provide EDL with the best alternatives for modernizing their electricity metering and revenue collection processes and systems for residential customers (BT level customers). The BT level customers are currently being metered using a variety of old and new electromechanical meters. Currently, the metering and revenue collection processes at EDL are manual, and prone to errors. The existing system does not provide EDL with reliable methods to readily check bills, identify problematic customers, and reduce fraud. Therefore, EDL's modernization requirements include an automated system capable of enhancing current metering processes, minimizing fraud, and maximizing revenue collection.

The Alpha-Gamma team investigated the applicability of automatic meter reading (AMR) for EDL. Both procedural and equipment modernization techniques were identified and assessed. The communication technologies investigated for electricity metering included optical, telephone, radio frequency, cellular, and line carrier. The advantages and disadvantages of each communication technology were assessed, and the RF communication technology was identified as the best alternative for EDL. In addition, based on costs obtained by the AlphaGamma team, the costs of purchasing new electromechanical meters equipped with communication modules is almost equal to the costs of purchasing the modules separately. Once this is combined with potential problems that EDL may face in retrofitting existing electromechanical meters and ensuring proper functioning, it is clear that retrofitting existing electromechanical meters is not a good alternative for this modernization project.

With new solid state (electronic) meters now available in the market, the Alpha-Gamma team reviewed two AMR alternatives applicable to BT level customers, including electronic meters equipped with RF modules and electromechanical meters equipped with RF modules. Based on cost data obtained from several meter suppliers, the functional requirements for metering residential customers, and expected benefits, the Alpha-Gamma team recommends that EDL use a combination of electromechanical and electronic meters, with electromechanical meters constituting about 85 % of the total meters. Both alternatives provide the necessary capability to reduce meter tampering and detect theft. Electronic meters are found to be a better alternative for use with problematic customers and high consumption level customers. In addition, EDL may choose to install electronic meters in newly developed and modernized regions, such as Solidere.

Several types of meter reading systems were investigated for their applicability to Lebanon, including mobile, fixed, and power line carrier systems. The system recommended to EDL is a mobile AMR system with meter reading and data collection centralized at EDL's

headquarters and interfaced with the current billing system. Mobile AMR with RF communication was identified as the ideal system for EDL because it is the least expensive, simple to install, quickest to implement, easiest to upgrade, compatible with other AMR systems, and field proven. In summary, the proposed system includes the following components:

1- New meters equipped with RF communication modules (943,000; - 85% electro-mechanical & 15% electronic meters)
2- Handheld computers capable of reading up to 2,000 meter reads per day (135 units)
3- Regional host computers (12 units)
4- Metering and route management software
5- Portable meter reading computer capable of reading up to 4,000 meter reads per day with spread spectrum (optional)
6- Vehicle meter reading computer capable of reading up to 25,000 meter reads per day with spread spectrum (optional)

In addition to the AMR system, the Alpha-Gamma team reviewed the current meter reading, billing, and revenue collection processes at EDL. As a result of this review and the requirements of the modernized system, new processes were identified and presented to EDL along with a detailed project implementation plan. In brief, the revised processes include:

1- Separation of meter reading and bill collection processes
2- Use of handheld computers for meter reading and validation of customer information
3- Enhanced classification and identification of customers
4- Placing responsibility on the customer to pay the bill and not on EDL to collect
5- Inclusion of separate receipt with each bill
6- Usage of electronic meters to verify suspected problematic customers
7- Imposing strict penalties on problematic customers
8- Disconnection of non-paying customers
9- Setup of regional collection centers or coordination with banks as collection centers
10- Providing incentives for customers to pay their bills with automatic bank drafts.

A phased implementation plan was developed based on a five-year implementation period.
Six main activities/steps were recommended for the phased implementation:

Step I- Purchase and introduce handheld computers in Year 1
Step 2- Modify the billing and collection processes, revise the customers' database, and conduct an ad campaign to inform customers with procedures for bill payment and penalties in Year I
Step 3- Install new meters with RF communication modules in years 2 through 5, targeting high consumption and problematic customers first

Step 4- Introduce one vehicle based meter reader in Year 2 to free some of the meter readers to perform other activities (optional)

Step 5- Begin executing the recommended procedures for dealing with problematic customers in Year 2

Step 6- Upgrade the billing system in Year 4 or Year 5 to meet EDL's growing requirements (optional)

Costs for the recommended system were obtained from several equipment suppliers. The Alpha-Gamma team invited ten equipment suppliers to provide costs for the proposed system. Four suppliers submitted detailed costs, and the overall system cost was estimated based on the average of the gathered cost information. Cost of the proposed system, including equipment, training, and setup, was estimated at $99 million. Annual operating costs were estimated at $126,000.

A cost benefit analysis was then conducted for the modernized system. It was determined that this system is economically and technically feasible with a payback period of 2.7 years. The payback period is defined as the period where the benefits of adopting the modernized system, when measured in dollars, equal the system's expected implementation costs. Uke all economic evaluations, there are uncertainties and risks associated with the estimated costs and benefits. It is possible that the payback period could be longer than the computed 2.7 years. The risks of the proposed project not meeting the desired goals were grouped into three main categories:

1- Performance of the vendors' equipment could fall short of expectation

2- Project implementation could take more time and cost more than planned

3- Project financing could be very expensive

The Alpha-Gamma team evaluated these risks using a Monte Carlo statistical analysis. The @ Risk program was used for the Monte Carlo study, and the result focused on the payback period as the measure of economic feasibility. The benefit categories that could be affected by these risks and the component costs were modeled in the analysis. In all, eight benefit categories and four cost categories were entered as variables in the Monte-Carlo simulation. The benefit categories were modeled in two ways, including triangular and uniform distribution, while the cost categories were modeled in uniform distribution only. The choice of triangular distribution shows confidence in the initial estimates, whereas using the uniform distribution implies that the variables could deviate substantially from the estimated values. The payback period determined from both analyses was around 3 years (3.18 for uniforms distribution for all inputs, and 3.12 for uniform distribution for costs and triangular distribution for benefits) with a maximum range of 2.2 to 4.7 years. The results of the risk analysis also indicate that the benefits from an aggressive revenue recovery process (identifying and reducing fraud and theft) have the most influence on reducing the project payback period. In addition, it was determined that the risk of higher financing costs has only minor effects on the project payback period. The project payback period increases by less than 2 months as the total costs are increased by 20% due to higher financing. Therefore, this study shows that the proposed modernization project is technically and economically feasible.

To further complete this feasibility study, the Alpha-Gamma team identified financial options for EDL for project financing, and developed a detailed procurement strategy for selecting the best supplier and equipment. It is anticipated that all of the system components would not be

available from one supplier; however, it is expected that EDL would be able to procure the complete system from two suppliers. Since AMR is a field proven technology that is currently used in the US and Europe, most of the AMR systems suppliers have developed an alliance resulting in completely compatible systems and components. It is therefore necessary for EDL to procure the systems identified under this project from such suppliers. In addition, it is imperative that the meter reading equipment including the handheld computers, the host computers, and all of the data collection systems be purchased from a single supplier. This is necessary to ensure the proper system operation, compatibility, integration, and modularity. A mechanism for evaluating bids from equipment suppliers is also presented. The recommended bid evaluation mechanism is based on price, functional specifications, quality, delivery, similar systems installed, and guarantees. In addition to the vendor evaluation mechanism, a complete vendor questionnaire was developed with assistance from EDL's personnel. The vendor questionnaire and qualification procedures are specifically tailored for EDL and incorporate similar qualification procedures that are currently implemented by EDL.

The final effort conducted under this study included developing Bidding Documents for the recommended metering system. These bid documents are consistent with current procedures and bid documents at EDL.

With the proposed modernization system, EDL's metering activities would become as advanced as the best US utilities, and will have the most advanced system in the region. Most importantly, with the modernized system, EDL will regain the confidence of its customers, and would become a highly reputable and revenue generating organization within the Ministry of Hydraulic and Electric Resources.